

What is claimed is:

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128.

An aerial launch and recovery system for an aircraft, said system comprising:

a lifting apparatus for carrying said aircraft to an elevated altitude,

a tow line connecting said lifting apparatus to a base structure,

launching means, and

5 arrestment means;

said lifting apparatus being aerielly deployed from said base structure, said launching

means being adapted to carry said aircraft to said elevated altitude and release said

aircraft for flight mode, said arrestment means being adapted to capture and retain said

aircraft from mid-air flight, said tow line enabling said lifting apparatus and said captured

10 aircraft to be pulled back to said base structure.

129.

An aerial launch system for an aircraft, said system comprising:

a lifting apparatus for carrying said aircraft to an elevated altitude,

a tow line connecting said lifting apparatus to a base structure, and

launching means,

5 said launching means being adapted to carry said aircraft to said elevated altitude and  
release said aircraft for flight mode.

130.

The aerial launch system of claim 129 in which said lifting apparatus is a parasail,  
said base structure comprising a transportable conveyance comprising a water craft  
capable of creating a relative wind through forward movement sufficient to provide lift to  
said parasail.

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131.

The aerial launch system of claim 129 in which said launching means comprises a housing for releasably receiving said aircraft, said housing being attached below said lifting apparatus.

132.

The aerial launch system of claim 129 in which a winch is provided to facilitate aerial deployment and recovery of said tow line, said winch enabling said lifting apparatus to be maintained at variable altitudes.

133.

The aerial launch system of claim 132 in which pulleys are provided for varying the point of deployment of said tow line from said base structure.

134.

The aerial launch system of claim 129 in which said lifting apparatus is a lighter-than-air balloon.

135.

The aerial launch system of claim 130 in which said lifting apparatus is a lighter-than-air balloon in combination within a parasail.

136.

The aerial launch system of claim 129 in which said base structure is a transportable conveyance comprising a wheeled vehicle.

137.

An aerial recovery system for an aircraft, said system comprising:

A lifting apparatus for carrying said recovery system to an elevated altitude,

a tow line connecting said aerial apparatus to a base structure, and

arrestment means;

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IPEA/US 23 FEB 2001

- 5 said lifting apparatus being aurally deployed from said base structure, said arrestment means being adapted to capture and retain said aircraft from mid-air flight, said tow line enabling said lifting apparatus and said captured aircraft to be pulled back to said base structure.

138.

The aerial recovery system of claim 137 in which said lifting apparatus is a parasail, said base structure comprises a transportable conveyance comprising a water craft capable of creating a relative wind through forward propulsion sufficient to provide lift to said parasail.

139.

The aerial recovery system of claim 138 in which means are provided for varying a geometry of a canopy of said parasail, whereby air drag on said parasail may be controlled.

140.

The aerial recovery system of claim 137 in which said lifting apparatus is a lighter-than-air balloon.

141.

The aerial recovery system of claim 137 in which said lifting apparatus is a lighter-than-air balloon in combination within a parasail.

142.

The aerial recovery system of claim 137 in which said base structure comprises a transportable conveyance comprising a wheeled vehicle.

143.

The aerial recovery system of claim 137 in which said arrestment means comprises a hook attached to said aircraft in such a position whereby said hook is

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adapted to engage an arrestment line supported by said aerial lifting apparatus as said aircraft comes into contact with said arrestment line.

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The aerial recovery system of claim 143 in which said arrestment line is said tow line.

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The aerial recovery system of claim 137 in which a hook is attached to said recovery system in such a position whereby said hook is adapted to engage an arrestment line attached to said aircraft as said aircraft comes into contact with said recovery system.

146.

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5 The aerial recovery system of claim 137 in which a high visibility strip of material is attached to said recovery system near the point of engagement of said aircraft to said recovery system to assist the pilot in acquiring and identifying the engagement point and for guidance in maneuvering said aircraft into engagement with said recovery system.

147.

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The aerial recovery system of claim 137 in which a camera is attached to said recovery system near the point of engagement of said aircraft to said recovery system, said camera pointing in the direction of said incoming aircraft so as to detect said aircraft for guidance in maneuvering said aircraft into engagement with said recovery system.

148.

The aerial recovery system of claim 137 in which said arrestment means is oriented such that said aircraft is captured from its flight path that is non-coincident.

149.

The aerial recovery system of claim 148 in which said flight path and the straight extension of said flight path does not pass vertically over said base structure.

PEA/US 23 FEB 2001

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150.

An aerial recovery system for an aircraft, said system comprising;

An arrestment cable held up at least one end,

Said aircraft contains a device for capturing said cable,

said aircraft contains structure suitable for deflecting said cable laterally into engagement

5 with said capturing device.

151.

The aerial recovery system of claim 150 where said cable is held up by a lifting apparatus.

152.

The aerial recovery system of claim 150 where said capturing device is a hook.

153.

The aerial recovery system of claim 150 where said hook has a cable retaining device.

154.

An aerial recovery system for an aircraft, said system comprising:

An arrestment cable, said cable attached at least one end to structure sufficient to

support the weight of the cable and aircraft, a hook attached to said aircraft, said arrestment cable is deflected laterally relative to said aircraft by aircraft structure into

5 engagement with said hook.

155.

The aerial recovery system of claim 150 in which said structure is the wing.

156.

The aerial recovery system of claim 150 in which a guide spanning between an attachment on a forward portion of a fuselage section of said aircraft to said wing directs said arrestment line to said capturing device.

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157.

The aerial recovery system of claim 150 in which said capturing device is positioned on a forward inboard edge of a wing of said aircraft.

158.

The aerial recovery system of claim 150 in which said capturing device is positioned on a section of a fuselage of said aircraft at a juncture of said fuselage section and a wing of said aircraft.

159.

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The aerial recovery system of claim 150 in which a propeller guard deflects said arrestment cable away from the propeller.

160.

An aerial recovery system for an aircraft, said system comprising:

An arrestment cable, said cable attached at least one end to structure sufficient to support the weight of the cable and aircraft, a hook attached to said aircraft, said arrestment cable is deflected laterally relative to said aircraft by aircraft structure into engagement with said hook.

161.

The aerial recovery system of claim 160 in which said arrestment line is deflected laterally inboard relative to said aircraft.

162.

The aerial recovery system of claim 160 in which said structure is swept aft 15 degrees or more to more reliably deflect said arrestment line to said hook.

163.

The aerial recovery system of claim 161 in which said structure is swept forward 20 degrees or more to more reliably deflect said arrestment line to said hook.

164.

The aerial recovery system of claim 160 in which said wing is mounted to the fuselage of said aircraft with a pivot, said pivot having a vertical axis which allows the wing to vary its sweep relative to the fuselage.

165.

The aerial recovery system of claim 160 in which said arrestment means further comprises a harness for suspending said aircraft in a level attitude, said harness being attached to a top surface of said aircraft, said harness having a lead end attached to said hook, said hook being detachable upon engagement with said arrestment line, whereby  
5 said harness is connectable with said arrestment line through said hook to effect level attitude suspension of said aircraft.

166.

The aerial recovery system of claim 160 in which said arrestment means further comprises a pivotable arm member for suspending said aircraft in a level attitude from said arrestment line, a pivot point of said pivotable arm being attached to a top surface of said aircraft, said pivotable arm having a distal end forming said hook, said pivotable arm  
5 being pivotable from a retracted position to an erected position upon engagement of said hook with said arrestment line, whereby said pivotable arm is connectable with said arrestment line through said hook to effect level attitude suspension of said aircraft.

167.

The aerial recovery system of claim 137 in which said arrestment means comprises:

at least one arrestment line suspended below said lifting apparatus,

a hook attached to said aircraft,

5 said hook being placed in such a position whereby said hook is adapted to engage said arrestment line as said aircraft comes into contact with said arrestment line.

IPEA/US 23 FEB 2001

168.

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The aerial recovery system of claim 137 in which there is an engagement point on the recovery system for contact and capture of said aircraft, a suspension cable supported by said lifting apparatus in turn supports said engagement point, a mechanism is provided to retract said suspension cable in order to raise said engagement point and said aircraft.

169.

The aerial recovery system of claim 137 in which there is an engagement point on the recovery system for contact and capture of said aircraft, a suspension cable supported by said lifting apparatus in turn supports said engagement point, a recovery line passes primarily forward from the engagement point to the base structure that is suitable for pulling said engagement point and aircraft over to said base structure.

170.

The aerial recovery system of claim 167 in which said arrestment line is suspended directly from the tow line.

171.

The aerial recovery system of claim 167 in which a plurality of arrestment lines are suspended below said lifting apparatus.

172.

The aerial recovery system of claim 171 in which at least some of said arrestment lines are suspended from said tow line.

173.

The aerial recovery system of claim 160 in which multiple arrestment lines are positioned in a parallel relationship and spaced apart at right angles to the direction of travel of said aircraft as it approaches for recovery so as to increase the lateral capture envelope of said recovery system.



174.

The aerial recovery system of claim 137 in which a winch is provided to facilitate aerial deployment and recovery of said tow line, said winch enabling said lifting apparatus to be maintained at variable altitudes.

175.

The aerial recovery system of claim 174 in which pulleys are provided for varying the point of deployment of said tow line from said base structure.

176.

A recovery system for an aircraft, said system comprising a vertically oriented arrestment line supported from a structure having sufficient height to position said arrestment line in a path of said aircraft when in flight such that said aircraft is adapted to engage said arrestment line to enable arrestment and recovery of said aircraft on said arrestment line.

177.

The recovery system of claim 176 where said structure is a boom.

178.

A recovery system for an aircraft, said system comprising a plurality of arrestment lines aligned in parallel orientation and having a spaced apart relationship to each other, said arrestment lines being supported from a structure having sufficient height to position said arrestment lines in a path of said aircraft when in flight such that said aircraft is adapted to engage at least one of said arrestment lines to enable arrestment and recovery of said aircraft on said arrestment lines.

179.

The recovery system of claim 178 in which said support structure comprises a boom, said arrestment lines being supported in a vertical orientation from said boom.

180.

The aerial recovery system of claim 137 in which said arrestment means contains a net.

181.

The aerial recovery system of claim 180 wherein said net is suspended from said tow line.

182.

The aerial recovery system of claim 180 in which said net hangs in a vertical plane.

183.

The aerial recovery system of claim 180 in which said net hangs in the plane of said tow line.

184.

An aerial recovery system for an aircraft, said system comprising:

A net, a draw string that passes around the periphery of said net and is slidably attached at points around the periphery of said net, a support system sufficient to carry the weight of the net and the aircraft, said draw string is connected to said support system and said draw string is suitable for pulling the periphery of the net together around the back of said aircraft to encapsulate said aircraft during arrestment.

185.

An aerial recovery system for an aircraft, said system comprising: an aerial apparatus for carrying said recovery system to an elevated altitude, a net to capture said aircraft, said net has at least three attach points spaced around the periphery of said net, lines attached to each of said net attach points extend up to support said net and aircraft from said aerial apparatus, the load on said lines during and after arrestment holds the net around said aircraft to help retain said aircraft.

186.

An aerial recovery system for an aircraft, said system comprising: an aerial apparatus for carrying said recovery system to an elevated altitude, a net to capture said aircraft, said net having aerodynamic drag producing fabric at the periphery of the net suitable for pulling the periphery of the net around said aircraft after engagement.

187.

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An aerial recovery system, said system comprising: an aircraft, a net suspended below a support system, said support system capable of holding the weight of the net and aircraft, a hook on said aircraft positioned so as to engage a line in said net during engagement.

188.

5 An aerial recovery system for an aircraft, said system comprising: an aerial lifting apparatus for carrying said recovery system to an elevated altitude, a contact location on said recovery system for engagement with said aircraft, a mechanization for increasing the travel of said contact location and said aircraft during recovery relative to said aerial apparatus.

189.

5 The aerial recovery system of claim 188 in which said mechanization is a hanging cable capable of carrying the weight of the aircraft, said cable is above and provides the support for said contact location, said hanging cable in turn is supported at its upper end by said aerial apparatus, said cable does not carry a towload from base structure to said aerial lifting apparatus said contact location being free to swing forward with said aircraft after engagement.

190.

The aerial recovery system of claim 188 in which said mechanization is a cable capable of carrying the weight of the aircraft, said cable prior to recovery is at right angles to the direction of travel of said aircraft and provides the support for said contact location, said cable in turn is supported at its upper end by said aerial apparatus, said contact location being capable of swinging forward with said aircraft after engagement.

191.

The aerial recovery system of Claim 188 in which said mechanization is an elastic element located in the structural load path between said contact location and said aerial apparatus.

192.

The aerial recovery system of claim 188 in which said mechanization is a sliding device located in the structural load path between said contact location and said aerial apparatus, said sliding device allowing movement of said aircraft relative to said aerial apparatus

193.

A method for launching and recovering an aircraft, said method comprising steps of:

lifting said aircraft to an elevated altitude by means of a lifting apparatus,  
connecting said lifting apparatus to a base structure by a tow line,  
launching said aircraft at said elevated altitude, and  
maneuvering said aircraft into arrestment means while in flight.

194.

The method for launching and recovering an aircraft of claim 193 in which said lifting apparatus is a parasail.

195.

A method for launching an aircraft, said method comprising steps of: lifting said aircraft to an elevated altitude by means of a lifting apparatus, connecting said lifting apparatus to a base structure by a tow line, and launching said aircraft at said elevated altitude.

196.

A method for recovering an aircraft, said method comprising steps of: deploying a lifting apparatus to an elevated altitude, connecting a lifting apparatus to a base structure by a tow line, and maneuvering said aircraft into arrestment means while in flight.

197.

The method for recovering an aircraft of claim 196 in which said lifting apparatus is a parasail.

198.

The method for recovering an aircraft of claim 196 in which said maneuvered aircraft is adapted to engage said recovery system while flying a non-coincident flight path.

199.

The method for recovering an aircraft of claim 196 in which said arrestment means are adapted to decrease an arrestment load placed on said aircraft during arrestment.

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200.

The aerial launch and recovery system of claim 128 in which said lifting apparatus is a parasail, said base structure comprising a transportable conveyance comprising a water craft capable of creating a relative wind through forward movement sufficient to provide lift to said parasail.

201.

The aerial launch and recovery system of claim 128 in which said launching means comprises a housing for releasably receiving said aircraft, said housing being attached below said lifting apparatus.

202.

The aerial launch and recovery system of claim 128 in which said launching means comprises a housing for releasably receiving said aircraft positioned on said tow line at a point remote from said lifting apparatus.

203.

The aerial launch and recovery system of claim 128 in which said arrestment means comprises a hook attached to said aircraft in such a position whereby said hook is adapted to engage said recovery system as said aircraft comes into contact with said recovery system.

204.

The aerial launch and recovery system of claim 128 in which said arrestment means is oriented such that said aircraft is captured from its flight path that is non-coincident.

205.

The aerial launch and recovery system of claim 128 in which said recovery system utilizes a net for recovery of said aircraft.

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206.

The aerial launch and recovery system of claim 128 in which said aircraft engages said recovery system at a point over said aircraft's center of gravity when said aircraft is in a level attitude thereby holding said aircraft in a level attitude.

207.

The aerial launch and recovery system of claim 203 in which said hook is positioned on a forward edge of a wing of said aircraft.

208.

The aircraft recovery system of claim 187 where said support system is a lifting apparatus.

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